

IN THE CLAIMS

Please amend the claims as follows:

1-137. (Canceled)

138. (Previously Presented) A processing method, comprising:

exposing a first surface of a first substrate to a plasma;

cleaning said first surface after exposure to said plasma;

terminating said first surface with a chemical species after said cleaning step; and

bonding said first surface to a second surface of a second substrate after said

terminating step.

139. (Previously Presented) A method as recited in claim 138, wherein terminating comprises:

immersing said first surface in a solution.

140. (Previously Presented) A method as recited in claim 138, wherein terminating comprises:

immersing said first surface in an N-based solution.

141. (Previously Presented) A method as recited in claim 138, wherein terminating comprises:

immersing said first surface in an ammonia-based solution.

142. (Previously Presented) A method as recited in claim 138, comprising:

performing said exposing, cleaning and terminating steps, in order, on said second surface of said second substrate prior to said bonding step.

143. (Previously Presented) A method as recited in claim 138, comprising:

forming a first bonding layer on said first substrate, and

performing said exposing, cleaning and terminating steps on a third surface of said first bonding layer.

144. (Previously Presented) A method as recited in claim 143, comprising:
forming a second bonding layer on said second substrate, and
performing said exposing, cleaning and terminating steps on a fourth surface of said second bonding layer formed on said second substrate.

145. (Previously Presented) A method as recited in claim 138, wherein said cleaning step comprises removing contaminants from said first surface.

146. (Previously Presented) A method as recited in claim 138, wherein:
said cleaning step comprises a dry process.

147. (Previously Presented) A method as recited in claim 146, wherein:
said terminating step comprises a dry process.

148. (Previously Presented) A method as recited in claim 146, wherein:
said terminating step comprises a wet process.

149. (Previously Presented) A processing method, comprising:
exposing a first surface of a first substrate to a first dry process to at least etch said first surface;
exposing said first surface to a second dry process to at least clean said first surface;
terminating said first surface with a chemical species; and
bonding said first surface to a second surface of a second substrate after said terminating step.

150. (Previously Presented) A method as recited in claim 149, comprising:
performing said exposing, cleaning and terminating steps, in order, on said second surface of said second substrate prior to said bonding step.

151. (Previously Presented) A method as recited in claim 149, comprising:
forming a first bonding layer on said first substrate, and

performing said exposing, cleaning and terminating steps on a third surface of said first bonding layer.

152. (Previously Presented) A method as recited in claim 151, comprising:
forming a second bonding layer on said second substrate, and
performing said exposing, cleaning and terminating steps on a fourth surface of said second bonding layer formed on said second substrate.

153. (Previously Presented) A method as recited in claim 149, wherein said cleaning step comprises removing contaminants from said first surface.

154. (Previously Presented) A method as recited in claim 149, comprising:
bonding said first surface to said second surface at about room temperature.

155. (Previously Presented) A method as recited in claim 149, comprising:
obtaining a bond strength at about room temperature sufficient to permit at least one of grinding and polishing of one of said first and second substrates.

156. (Previously Presented) A method as recited in claim 149, comprising:
obtaining a bond strength of at least about 500 mJ/m^2 at about room temperature.

157. (Previously Presented) A method as recited in claim 149, comprising:
obtaining a bond strength of at least about 1000 mJ/m^2 at about room temperature.

158. (Previously Presented) A method as recited in claim 149, comprising:
obtaining a bond strength of at least about 2000 mJ/m^2 at about room temperature.

159. (Previously Presented) A method as recited in claim 149, wherein:
forming a chemical bond at about room temperature.

160. (Previously Presented) A method as recited in claim 149, wherein:
said second dry process comprises a NH_3 plasma process.

161. (Previously Presented) A method as recited in claim 138, comprising:
bonding said first surface to said second surface at about room temperature.

162. (Previously Presented) A method as recited in claim 138, comprising:
obtaining a bond strength at about room temperature sufficient to permit at least one of grinding and polishing of one of said first and second substrates.

163. (Previously Presented) A method as recited in claim 138, comprising:
obtaining a bond strength of at least about 500 mJ/m^2 at about room temperature.

164. (Previously Presented) A method as recited in claim 138, comprising:
obtaining a bond strength of at least about 1000 mJ/m^2 at about room temperature.

165. (Previously Presented) A method as recited in claim 138, comprising:
obtaining a bond strength of at least about 2000 mJ/m^2 at about room temperature.

166. (Previously Presented) A method as recited in claim 138, wherein:
forming a chemical bond at about room temperature.

167. (Previously Presented) A method as recited in claim 138, wherein said cleaning step comprises cleaning said first surface with an ammonia-based process.

168. (Previously Presented) A processing method, comprising:
exposing a first surface of a first element to a first dry process to at least etch said first surface;
exposing said first surface to a second dry process to at least clean said first surface;
terminating said first surface with a chemical species; and
bonding said first surface to a second surface of a second element after said terminating step.

169. (Previously Presented) A method as recited in claim 168, wherein terminating comprises:
immersing said first surface in a solution.

170. (Previously Presented) A method as recited in claim 168, wherein terminating comprises:

immersing said first surface in an N-based solution.

171. (Previously Presented) A method as recited in claim 168, wherein terminating comprises:

immersing said first surface in an ammonia-based solution.

172. (Previously Presented) A method as recited in claim 168, comprising:

performing said exposing, cleaning and terminating steps, in order, on said second surface prior to said bonding step.

173. (Previously Presented) A method as recited in claim 168, comprising:

forming a first bonding layer on said first element, and

performing said exposing, cleaning and terminating steps on a third surface of said first bonding layer.

174. (Previously Presented) A method as recited in claim 173, comprising:

forming a second bonding layer on said second element, and

performing said exposing, cleaning and terminating steps on a fourth surface of said second bonding layer.

175. (Previously Presented) A method as recited in claim 168, wherein said cleaning

step comprises removing contaminants from said first surface.

176. (Canceled)

177. (Previously Presented) A method as recited in claim 168, wherein:

said terminating step comprises a dry process.

178. (Previously Presented) A method as recited in claim 168, wherein:

said terminating step comprises a wet process.

179. (Previously Presented) A method as recited in claim 168, comprising:

bonding said first surface to said second surface at about room temperature.

180. (Previously Presented) A method as recited in claim 168, comprising:

obtaining a bond strength at about room temperature sufficient to permit at least one of grinding and polishing of one of said first and second elements.

181. (Previously Presented) A method as recited in claim 168, comprising:
obtaining a bond strength of at least about 500 mJ/m^2 at about room temperature.

182. (Previously Presented) A method as recited in claim 168, comprising:
obtaining a bond strength of at least about 1000 mJ/m^2 at about room temperature.

183. (Previously Presented) A method as recited in claim 168, comprising:
obtaining a bond strength of at least about 2000 mJ/m^2 at about room temperature.

184. (Previously Presented) A method as recited in claim 168, wherein:
forming a chemical bond at about room temperature.

185. (Previously Presented) A method as recited in claim 168, wherein said cleaning step comprises cleaning said first surface with an ammonia-based process.

186. (Previously Presented) A processing method, comprising:
exposing a first surface of a first element to a plasma;
cleaning said first surface after exposure to said plasma;
terminating said first surface with a chemical species after said cleaning step; and
bonding said first surface to a second surface of a second element after said terminating step.

187. (Previously Presented) A method as recited in claim 186, comprising:
performing said exposing, cleaning and terminating steps, in order, on said second surface prior to said bonding step.

188. (Previously Presented) A method as recited in claim 186, comprising:
forming a first bonding layer on said first element, and
performing said exposing, cleaning and terminating steps on a third surface of said first bonding layer.

189. (Previously Presented) A method as recited in claim 188, comprising:
forming a second bonding layer on said second element, and
performing said exposing, cleaning and terminating steps on a fourth surface of said second bonding layer.

190. (Previously Presented) A method as recited in claim 186, wherein said cleaning step comprises removing contaminants from said first surface.

191. (Previously Presented) A method as recited in claim 186, comprising:
bonding said first surface to said second surface at about room temperature.

192. (Previously Presented) A method as recited in claim 186, comprising:
obtaining a bond strength at about room temperature sufficient to permit at least one of grinding and polishing of one of said first and second elements.

193. (Previously Presented) A method as recited in claim 186, comprising:
obtaining a bond strength of at least about 500 mJ/m^2 at about room temperature.

194. (Previously Presented) A method as recited in claim 186, comprising:
obtaining a bond strength of at least about 1000 mJ/m^2 at about room temperature.

195. (Previously Presented) A method as recited in claim 186, comprising:
obtaining a bond strength of at least about 2000 mJ/m^2 at about room temperature.

196. (Previously Presented) A method as recited in claim 186, wherein:
forming a chemical bond at about room temperature.

197. (Previously Presented) A method as recited in claim 186, wherein:
said cleaning step comprises a NH_3 plasma process.

198. (Previously Presented) A method as recited in claim 186, comprising:
heating said first and second elements to a temperature no more than about 200°C .

199. (Previously Presented) A method as recited in claim 198, comprising:
obtaining a bond strength of at least about 500 mJ/m^2 .

200. (Previously Presented) A method as recited in claim 198, comprising:
obtaining a bond strength of at least about 1000 mJ/m².
201. (Previously Presented) A method as recited in claim 198, comprising:
obtaining a bond strength of at least about 2000 mJ/m².
202. (Currently Amended) A method as recited in claim 186, comprising:
heating said first and second elements to a temperature in a range of about 75-100° C.
203. (Previously Presented) A method as recited in claim 202, comprising:
obtaining a bond strength of at least about 500 mJ/m².
204. (Previously Presented) A method as recited in claim 202, comprising:
obtaining a bond strength of at least about 1000 mJ/m².
205. (Previously Presented) A method as recited in claim 202, comprising:
obtaining a bond strength of at least about 2000 mJ/m².
206. (Previously Presented) A method as recited in claim 186, comprising:
heating said first and second elements to increase a bond strength between said first
and second elements.
207. (Previously Presented) A method as recited in claim 206, comprising:
obtaining a bond strength of at least about 500 mJ/m².
208. (Previously Presented) A method as recited in claim 206, comprising:
obtaining a bond strength of at least about 1000 mJ/m².
209. (Previously Presented) A method as recited in claim 206, comprising:
obtaining a bond strength of at least about 2000 mJ/m².
210. (Previously Presented) A method as recited in claim 186, wherein:
each of said first and second elements is a substrate.
211. (Previously Presented) A method as recited in claim 149, comprising:
heating said first and second substrates to a temperature no more than about 200° C.

212. (Previously Presented) A method as recited in claim 211, comprising:
obtaining a bond strength of at least about 500 mJ/m².
213. (Previously Presented) A method as recited in claim 211, comprising:
obtaining a bond strength of at least about 1000 mJ/m².
214. (Previously Presented) A method as recited in claim 211, comprising:
obtaining a bond strength of at least about 2000 mJ/m².
215. (Currently Amended) A method as recited in claim 149, comprising:
heating said first and second substrates to a temperature in a range of about 75-100°

C.

216. (Previously Presented) A method as recited in claim 215, comprising:
obtaining a bond strength of at least about 500 mJ/m².
217. (Previously Presented) A method as recited in claim 215, comprising:
obtaining a bond strength of at least about 1000 mJ/m².
218. (Previously Presented) A method as recited in claim 215, comprising:
obtaining a bond strength of at least about 2000 mJ/m².
219. (Previously Presented) A method as recited in claim 149, comprising:
heating said first and second substrates to enhance a bond strength between said first
and second substrates.
220. (Previously Presented) A method as recited in claim 219, comprising:
obtaining a bond strength of at least about 500 mJ/m².
221. (Previously Presented) A method as recited in claim 219, comprising:
obtaining a bond strength of at least about 1000 mJ/m².
222. (Previously Presented) A method as recited in claim 219, comprising:
obtaining a bond strength of at least about 2000 mJ/m².
223. (Previously Presented) A method as recited in claim 138, comprising:

heating said first and second substrates to a temperature no more than about 200° C.

224. (Previously Presented) A method as recited in claim 223, comprising:

obtaining a bond strength of at least about 500 mJ/m².

225. (Previously Presented) A method as recited in claim 223, comprising:

obtaining a bond strength of at least about 1000 mJ/m².

226. (Previously Presented) A method as recited in claim 223, comprising:

obtaining a bond strength of at least about 2000 mJ/m².

227. (Currently Amended) A method as recited in claim 138, comprising:

heating said first and second substrates to a temperature in a range of about 75-100°

C.

228. (Previously Presented) A method as recited in claim 227, comprising:

obtaining a bond strength of at least about 500 mJ/m².

229. (Previously Presented) A method as recited in claim 227, comprising:

obtaining a bond strength of at least about 1000 mJ/m².

230. (Previously Presented) A method as recited in claim 227, comprising:

obtaining a bond strength of at least about 2000 mJ/m².

231. (Previously Presented) A method as recited in claim 138, comprising:

heating said first and second substrates to enhance a bond strength between said first
and second substrates.

232. (Previously Presented) A method as recited in claim 231, comprising:

obtaining a bond strength of at least about 500 mJ/m².

233. (Previously Presented) A method as recited in claim 231, comprising:

obtaining a bond strength of at least about 1000 mJ/m².

234. (Previously Presented) A method as recited in claim 231, comprising:

obtaining a bond strength of at least about 2000 mJ/m².

235. (Currently Amended) A processing method, comprising:

exposing a first surface of a first element to a plasma;

cleaning said first surface after exposure to said plasma;

terminating said first surface with a chemical species after exposure to said plasma;

[[and]]

bonding said first surface to a second surface of a second element after said

terminating step; and

obtaining a bond strength of at least about 500 mJ/m².

236. (Previously Presented) A processing method, comprising:

exposing a first surface of a first element to a plasma;

cleaning said first surface after exposure to said plasma and terminating said first surface with a chemical species in a same step; and

bonding said first surface to a second surface of a second element after said

terminating step.

237. (Previously Presented) A method as recited in claim 235, comprising:

forming a first bonding layer on said first element, and

performing said exposing, cleaning and terminating on a surface of said first bonding layer.

238. (Previously Presented) A method as recited in claim 237, comprising:

forming a second bonding layer on said second element, and

performing said exposing, cleaning and terminating on a surface of said second bonding layer.

239. (Previously Presented) A method as recited in claim 235, wherein said cleaning step comprises removing contaminants from said first surface.

240. (Previously Presented) A method as recited in claim 235, wherein:

said cleaning step comprises a dry process.

241. (Previously Presented) A method as recited in claim 235, wherein:

said terminating step comprises a dry process.

242. (Previously Presented) A method as recited in claim 235, comprising:

obtaining a bond strength sufficient to permit at least one of grinding and polishing of one of said first and second elements.

243. (Canceled)

244. (Previously Presented) A method as recited in claim 235, comprising:

obtaining a bond strength of at least about 1000 mJ/m^2 .

245. (Previously Presented) A method as recited in claim 235, comprising:

obtaining a bond strength of at least about 2000 mJ/m^2 .

246. (Currently Amended) A processing method as recited in claim 235, comprising:

exposing a first surface of a first element to a plasma;

cleaning said first surface after exposure to said plasma;

terminating said first surface with a chemical species after exposure to said plasma;

bonding said first surface to a second surface of a second element after said

terminating step; and

forming a chemical bond between said first and second elements.

247. (Currently Amended) A method as recited in claim 235, comprising:

heating said first and second ~~substrates~~ elements to a temperature no more than about 200°C .

248. (Canceled)

249. (Previously Presented) A method as recited in claim 247, comprising:

obtaining a bond strength of at least about 1000 mJ/m^2 .

250. (Previously Presented) A method as recited in claim 247, comprising:

obtaining a bond strength of at least about 2000 mJ/m^2 .

251. (Currently Amended) A method as recited in claim 235, comprising:

heating said first and second ~~substrates~~ elements to a temperature in a range of about 75-100° C.

252. (Canceled)

253. (Previously Presented) A method as recited in claim 251, comprising:

obtaining a bond strength of at least about 1000 mJ/m^2 .

254. (Previously Presented) A method as recited in claim 251, comprising:

obtaining a bond strength of at least about 2000 mJ/m^2 .

255. (Currently Amended) A method as recited in claim 235, comprising:

heating said first and second ~~substrates~~ elements to enhance a bond strength between said first and second elements.

256. (Canceled)

257. (Previously Presented) A method as recited in claim 255, comprising:

obtaining a bond strength of at least about 1000 mJ/m^2 .

258. (Previously Presented) A method as recited in claim 255, comprising:

obtaining a bond strength of at least about 2000 mJ/m^2 .

259. (Previously Presented) A method as recited in claim 235, wherein:

each of said first and second elements is a substrate.

260. (Previously Presented) A method as recited in claim 236, comprising:

forming a first bonding layer on said first element, and

performing said exposing, cleaning and terminating on a surface of said first bonding layer.

261. (Previously Presented) A method as recited in claim 260, comprising:

forming a second bonding layer on said second element, and

performing said exposing, cleaning and terminating on a surface of said second bonding layer.

262. (Previously Presented) A method as recited in claim 236, wherein said cleaning step comprises removing contaminants from said first surface.

263. (Previously Presented) A method as recited in claim 236, wherein:
said cleaning step comprises a dry process.

264. (Previously Presented) A method as recited in claim 236, wherein:
said terminating step comprises a dry process.

265. (Previously Presented) A method as recited in claim 236, comprising:
obtaining a bond strength sufficient to permit at least one of grinding and polishing of one of said first and second elements.

266. (Previously Presented) A method as recited in claim 236, comprising:
obtaining a bond strength of at least about 500 mJ/m^2 .

267. (Previously Presented) A method as recited in claim 236, comprising:
obtaining a bond strength of at least about 1000 mJ/m^2 .

268. (Previously Presented) A method as recited in claim 236, comprising:
obtaining a bond strength of at least about 2000 mJ/m^2 .

269. (Previously Presented) A method as recited in claim 236, comprising:
forming a chemical bond between said first and second elements.

270. (Currently Amended) A method as recited in claim 236, comprising:
heating said first and second ~~substrates~~ elements to a temperature no more than about 200°C .

271. (Previously Presented) A method as recited in claim 270, comprising:
obtaining a bond strength of at least about 500 mJ/m^2 .

272. (Previously Presented) A method as recited in claim 270, comprising:

obtaining a bond strength of at least about 1000 mJ/m².

273. (Previously Presented) A method as recited in claim 270, comprising:

obtaining a bond strength of at least about 2000 mJ/m².

274. (Currently Amended) A method as recited in claim 236, comprising:

heating said first and second ~~substrates~~ elements to a temperature in a range of about 75-100° C.

275. (Previously Presented) A method as recited in claim 274, comprising:

obtaining a bond strength of at least about 500 mJ/m².

276. (Previously Presented) A method as recited in claim 274, comprising:

obtaining a bond strength of at least about 1000 mJ/m².

277. (Previously Presented) A method as recited in claim 274, comprising:

obtaining a bond strength of at least about 2000 mJ/m².

278. (Currently Amended) A method as recited in claim 236, comprising:

heating said first and second ~~substrates~~ elements to enhance a bond strength between said first and second elements.

279. (Previously Presented) A method as recited in claim 278, comprising:

obtaining a bond strength of at least about 500 mJ/m².

280. (Previously Presented) A method as recited in claim 278, comprising:

obtaining a bond strength of at least about 1000 mJ/m².

281. (Previously Presented) A method as recited in claim 278, comprising:

obtaining a bond strength of at least about 2000 mJ/m².

282. (Previously Presented) A method as recited in claim 236, wherein:

each of said first and second elements is a substrate.

283. (Previously Presented) A method as recited in claim 236, wherein:

said terminating step comprises a wet process.

284. (Previously Presented) A method as recited in claim 236, wherein terminating comprises:

immersing said first surface in a solution.

285. (Previously Presented) A method as recited in claim 236, wherein terminating comprises:

immersing said first surface in an N-based solution.

286. (Previously Presented) A method as recited in claim 236, wherein terminating comprises:

immersing said first surface in an ammonia-based solution.

287. (Previously Presented) A method as recited in claim 186, wherein:

said terminating step comprises a wet process.

288. (Previously Presented) A method as recited in claim 186, wherein terminating comprises:

immersing said first surface in a solution.

289. (Previously Presented) A method as recited in claim 186, wherein terminating comprises:

immersing said first surface in an N-based solution.

290. (Previously Presented) A method as recited in claim 186, wherein terminating comprises:

immersing said first surface in an ammonia-based solution.

291. (Previously Presented) A method as recited in claim 235, wherein:

said terminating step comprises a wet process.

292. (Previously Presented) A method as recited in claim 235, wherein terminating comprises:

immersing said first surface in a solution.

293. (Previously Presented) A method as recited in claim 235, wherein terminating comprises:

immersing said first surface in an N-based solution.

294. (Previously Presented) A method as recited in claim 235, wherein terminating comprises:

immersing said first surface in an ammonia-based solution.

295. (Canceled)

296. (New) A method as recited in claim 246, comprising:

heating said first and second elements to a temperature no more than about 200° C.

297. (New) A method as recited in claim 246, comprising:

heating said first and second elements to a temperature in a range of about 75-100° C.

298. (New) A method as recited in claim 246, comprising:

heating said first and second elements to enhance a bond strength between said first and second elements.

299. (New) A method as recited in claim 246, wherein:

said terminating step comprises a wet process.

300. (New) A method as recited in claim 246, wherein terminating comprises:

immersing said first surface in a solution.

301. (New) A method as recited in claim 246, wherein terminating comprises:

immersing said first surface in an N-based solution.

302. (New) A method as recited in claim 246, wherein terminating comprises:

immersing said first surface in an ammonia-based solution.

303. (New) A method as recited in claim 246, comprising:

forming a first bonding layer on said first element, and

performing said exposing, cleaning and terminating on a surface of said first bonding layer.

304. (New) A method as recited in claim 246, comprising:
forming a second bonding layer on said second element, and
performing said exposing, cleaning and terminating on a surface of said second bonding layer.

305. (New) A method as recited in claim 246, wherein:
said cleaning step comprises a dry process.

306. (New) A method as recited in claim 246, wherein:
said terminating step comprises a dry process.